DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which an invention belongs] This invention relates to a high intensity dielectric sputtering target the capacitor film formation of next-generation high integration semiconductor memory, and for functional dielectric membrane formation, and a manufacturing method for the same.

[0002]

[Description of the Prior Art]As a Prior art, Ti system (Ba, Sr) oxide powder is sintered in a vacuum and a reducing atmosphere as shown in JP,6-330297,A, if an oxygen-deficiency type oxide target is made, the electrical resistivity of this sintered compact target will be 10 or less ohm-m, and stable DC sputtering will become possible -- ****** -- it is known that high-speed membrane formation will be attained.

[0003]

[Problem(s) to be Solved by the Invention]In recent years, in order to obtain membrane formation at a high speed more, high-power sputtering is coming to be demanded more further. However, the actual condition is a target material's breaking at the time of sputtering in high power, or crack generating taking place in the target of the above-mentioned conventional technology, and there being a problem the scene which interferes with realization of the stable membrane formation at a high speed being seen, and fully being unable to respond to the above-mentioned request.

[0004]

[Means for Solving the Problem]Then, this invention persons have high thermal shock resistance, and more also at the time of high-power sputtering. A place which advanced research wholeheartedly in order for a target material to break or to obtain a target which has the outstanding performance in which crack generating does not occur, In a sintered compact sputtering target expressed with general formula $Ba_{1-x}Sr_xTiO_{3-y}$ ($0< x<1$, $0< y<=0.03$) with an oxygen deficiency, Primary [an average of] particle diameter 1100 ** - 1300 **; sintering time for sintering temperature using precursor powder which is 1 micrometer or less For example, 1hr - 10hr, Mean particle diameter of a sintered compact by adjusting 20 micrometers or less and relative density, and adjusting purity for 0.3-5 micrometers and a diameter of grain of maximum size more than 4N 95% - 99% by carrying out the hotpress of the pressure in 10MPa - 50MPa, a vacuum, or inert atmosphere gas, If 5 ppm or less and Si shall be 20 ppm or less and Fe shall be 2 ppm or less and aluminum 2 ppm or less for 1 ppm or less and Na among minute impurities if needed, K, Also more in the time of high-power DC sputtering a target using a target material manufactured from this sintered compact has high density and fine

texture structure, and its three point bending intensity improves by 2 to 5 times the conventional material, and by having been high-intensity-ized, Knowledge that it becomes a high intensity dielectric sputtering target which can respond to the above-mentioned request enough was acquired.

[0005]In a sintered compact sputtering target expressed with general formula $Ba_{1-x}Sr_xTiO_{3-y}$ (0< x<1, 0< y<=0.03) where this invention is obtained based on the above-mentioned knowledge, and which has (1) oxygen deficiency, In mean particle diameter of this sintered compact, at 0.3-5 micrometers, a diameter of grain of maximum size at 20 micrometers or less. A high intensity dielectric sputtering target whose relative density is more than purity 4N at 95% - 99%, In K, 1 ppm or less and Na among minute impurities (2) 2 ppm or less, A high intensity dielectric sputtering target given in (1) 5 ppm or less and Si are 20 ppm or less, and aluminum is [given Fe] 2 ppm or less, Primary [an average of] particle diameter using precursor powder which is 1 micrometer or less (3) Sintering temperature of 1100 ** - 1300 **, It has the feature, without a manufacturing method of a high intensity dielectric sputtering target of (1) or (2) statements which carried out the hotpress in sintering time 1hr - 10hr, pressure 10MPa - 50MPa, a vacuum, or inert atmosphere gas.

[0006]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described. First, obtain BaO and SrO which were high-grade-ized by recrystallizing method or distillation, and TiO_2 powder, and mix these powder at a predetermined rate, respectively, and it cracks, after heat-treating at 1100 ** among the atmosphere, $TiO(Ba, Sr)_3$ powder with the Perovskite type crystal structure beyond purity 4N was obtained. The first [an average of] particle diameter of this powder was 0.05-1 micrometer. Fill up a hotpress graphite mold with the above-mentioned powder, and for example, in a vacuum or inert atmosphere gas, A hotpress is carried out on condition of the sintering temperature of 1100 ** - 1300 **, sintering time 1hr - 10hr, pressure 10MPa - 50MPa, Mean particle diameter produces a sintered compact with the oxygen deficiency of general formula $Ba_{1-x}Sr_xTiO_{3-y}$ beyond purity 4N (0< x<1, 0< y<=0.03) 0.3-5 micrometers and whose diameter of grain of maximum size are 20 micrometers or less and whose relative density is 95% - 99%. With the transverse test piece cut down and produced from the above-mentioned sintered compact, when three point bending intensity was measured, average anti-chip box intensity showed the intensity of the sintered compact 2 to 5 times the high intensity of an average anti-chip box conventionally by 150 or more MPa. Subsequently, the above-mentioned sintered compact was processed into phi125x5mmt, In-Sn solder was used for copper packing plates, bonding of this was carried out to them, it was considered as the sputtering target, and DC-sputtering power crack tolerance and a membrane formation speed test were done. As a result, without being divided below in DC500 (W),

sputtering is possible and the highest membrane formation speed is 250 A (it is hereafter described as A) / more than min, It is two to 3 times over the past, and is a dielectric sputtering target of the high intensity which has the outstanding performance also in sputtering under high power.

[0007]The high grade-ization in the end of precursor powder is faced in manufacture of the above-mentioned sintered compact, K by adjusting 5 ppm or less and Si to 20 ppm or less, and adjusting [1 ppm or less and Na] Fe for 2 ppm or less and aluminum to 2 ppm or less among the minute impurities which repeat and enforce recrystallizing method, distillation, etc. and are contained in the end of precursor powder, The sputtering target obtained turns into a dielectric sputtering target of the high intensity which has the performance which was excellent rather than a value also with possible sputtering and the quicker highest membrane formation speed was shown, without being divided to higher power density at the time of sputtering.

[0008]Hereafter, the reason for having carried out the numerical limitation is explained like the above.

(a) If the value of ********** of a sintered compact exceeds 5 micrometers, the average anti-chip box intensity of a sintered compact will fall, and, as a result, a target material will break in low power during sputtering. On the other hand, at less than 0.3 micrometer, since it was difficult to manufacture a high-density sintered compact with the manufacturing method of this invention, the value provided the value in 0.3-5 micrometers.

[0009](b) Since the average anti-chip box intensity of the sintered compact fell extremely and the target material broke in low power during sputtering when the value of the maximum ******** of a sintered compact exceeded 20 micrometers, the value was provided in 20 micrometers or less.

[0010](c) Whenever it was [relative / of the sintered compact] dense, when that value exceeded 99% on the other hand from it becoming impossible for a sintered compact to obtain high intensity in less than 95% in this value, since thermal shock resistance fell, that value was defined to 95% - 99%.

[0011](d) Less than [of the sintered compact / purity purity 4N], there is a problem which the particle growth of a sintered compact tends to follow, and the value was defined more than 4N.

[0012]Since the minute impurities contained in a sintered compact are participating in phenomena, such as a crack of the target material under sputtering, they are adjusted about the quantity if needed, but. It is desirable to adjust in the range of this value by 1 ppm or less and Na, by K, since it is further effective by prevention of the above-mentioned phenomenon by 5 ppm or less and Si with 2 ppm or less and aluminum in it being 2 ppm or less in 20 ppm or less and Fe.

[0013]As for the value, since the mean particle diameter of a sintered compact will exceed 5

micrometers, the average anti-chip box intensity of a sintered compact will fall as a result and a target material will break in low power during sputtering when the value of the primary [an average of] particle diameter in the end of precursor powder exceeds 1 micrometer, 1 micrometer or less is desirable.

[0014]Although sintering temperature and sintering time carry out the operation which adjusts the density of an oxide sintered body, and particle diameter, If the high density which needs those values at less than 1100 ** and less than 1 hr is not acquired, but those values exceed 1300 ** on the other hand and 10hr is exceeded when carrying out the hotpress of the precursor powder end beyond purity 4N, Since grain growth arises and required particle diameter is not obtained, the value has the desirable range of 1100-1300 **.

CLAIMS

[Claim(s)]

[Claim 1]In a sintered compact sputtering target expressed with general formula $Ba_{1-x}Sr_xTiO_{3-y}$ ($0< x<1$, $0< y<=0.03$) with an oxygen deficiency, mean particle diameter of this sintered compact at 0.3-5 micrometers. A high intensity dielectric sputtering target in which a diameter of grain of maximum size is characterized by relative density being more than purity 4N at 95% - 99% at 20 micrometers or less.

[Claim 2]The high intensity dielectric sputtering target according to claim 1 in which K is characterized by 5 ppm or less and Si being 20 ppm or less, and 2 ppm or less and aluminum being [Fe of 1 ppm or less and Na] 2 ppm or less among minute impurities.

[Claim 3]Primary [an average of] particle diameter using precursor powder which is 1 micrometer or less Sintering temperature of 1100 ** - 1300 **, A manufacturing method of the high intensity dielectric sputtering target according to claim 1 or 2 carrying out a hotpress in sintering time 1hr - 10hr, pressure 10MPa - 50MPa, a vacuum, or inert atmosphere gas.